MA 16100 - Exam 3 - 11/16/2023
TEST NUMBER: $\boxed{11}$ - (GREEN Booklet)

NAME ______________________ **YOUR TA'S NAME** ________________________

STUDENT ID # ________________ **RECITATION TIME** ________________

Be sure the paper you are looking at right now is GREEN and matched with the color of the scantron! Write $\boxed{\mathbf{11}}$ in the TEST/QUIZ NUMBER boxes and blacken the appropriate spaces on the scantron. Use a #2 pencil for the scantron and fill in:

1. Your name. If there's not enough space, fill in as much as you can.
2. Section number. If you don't know your section number, ask your TA.
3. Test/Quiz number: $\boxed{\mathbf{11}}$
4. Student Identification Number: **Your Purdue ID Number with two leading zeros**

There are **12** questions, each worth 8 points (you will automatically earn 4 points for filling out your student ID number correctly). Blacken your answer choice on the scantron for questions 1-12. Use this exam booklet for all your work and use the back of the test pages for scrap paper. Submit both the scantron and the exam booklet when finished.

If you finish the exam before 8:50 PM, you may leave the room after turning in the scantron sheet and the exam booklet. You may not leave the room before 8:20 PM. If you don't finish by 8:50 PM, you MUST REMAIN SEATED until your TA collects your materials.

EXAM POLICIES

1. Students may not open the exam until instructed to do so.
2. Students must obey the orders and requests by all proctors, TAs, and lecturers.
3. No student may leave in the first 20 min or in the last 10 min of the exam.
4. Books, notes, calculators, or any electronic devices are not allowed on the exam, and they should not even be in sight in the exam room. Students may not look at anybody else's test, and may not communicate with anybody else except, if they have a question, with their TA or lecturer.
5. After time is called, the students have to put down all writing instruments and remain in their seats, while the TAs will collect the scantrons and the exams.
6. Any violation of these rules and any act of academic dishonesty may result in severe penalties. Additionally, all violators will be reported to the Office of the Dean of Students.

I have read and understand the exam rules stated above:

STUDENT SIGNATURE: ____

1. A farmer has 120 feet of fencing to enclose a rectangular garden. The farmer wants to maximize the area of the garden to yield more produce. The garden will be adjacent to a barn, so only three sides need to be fenced. What is the maximum such area of the rectangular garden?

A. $600 \ \text{ft}^2$

B. $750 \ \text{ft}^2$

C. $900 \ \text{ft}^2$

D. $1200 \ \text{ft}^2$

E. $1800 \ \text{ft}^2$

2. Using linear approximation to estimate $\sqrt{25.4}$, the approximate value is

A. 5.02

B. 5.04

C. 5.06

D. 5.08

E. 5.10

3. Evaluate $\lim_{x \to 0} \dfrac{\cos(5x) - 3x - 1}{7x^2 + 5x}$

A. $\dfrac{-3}{5}$

B. $\dfrac{3}{5}$

C. $\dfrac{25}{14}$

D. $\dfrac{-25}{14}$

E. Limit does not exist.

4. Suppose $f''(x) = e^{-x}(x^2 - 4x + 3)$ and $f'(1) = 0$. At $x = 1, f$ has

A. A local maximum

B. A local minimum

C. An inflection point

D. None of these

E. Impossible to determine

5. Consider the function $f(x) = x - 2\sin(x)$ on the domain $[0, 2\pi]$. On which of the following intervals is the graph of $f(x)$ concave down?

A. $\left(0, \pi\right)$

B. $\left(\pi, 2\pi\right)$

C. $\left(0, \frac{\pi}{2}\right)$ and $\left(\frac{3\pi}{2}, 2\pi\right)$

D. $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$

E. $\left(\frac{\pi}{2}, \pi\right)$

6. Consider the function $f(x) = 2^x$. What is the estimated area under the curve from $x = -2$ to $x = 1$ using a Riemann sum with three rectangles and right end points?

A. 0.25 square units

B. 1.75 square units

C. 2.5 square units

D. 3.5 square units

E. 3.75 square units

7. Compute: $\lim_{x \to 0+} \Big(1 + \sin(6x)\Big)^{\frac{1}{2x}}$

A. e^{12}

B. e^{6}

C. e^{3}

D. $e^{0.5}$

E. $e^{\sin 6x}$

8. Evaluate the indefinite integral $\int \frac{6}{\sqrt{x}} - 7\cos(x) + \frac{5}{1+x^2}\,dx$

A. $12\sqrt{x} - 7\sin(x) + 5\tan^{-1}(x) + C$

B. $6\sqrt{x} - 7\sin(x) + \tan^{-1}(5x) + C$

C. $6\sqrt{x} - 7\sin(x) + 5\tan^{-1}(x) + C$

D. $12\sqrt{x} + 7\sin(x) + \tan^{-1}(5x) + C$

E. $\frac{-3}{\sqrt{x^3}} + 7\sin(x) + 5\tan^{-1}(x) + C$

9. If $F(x)$ is the unique solution to the Initial Value Problem $\begin{cases} F''(x) = 12x + 5 \\ F(0) = 1 \\ F'(0) = -0.5 \end{cases}$. Then

A. $F(1) = 3.5$

B. $F(1) = 4$

C. $F(1) = 4.5$

D. $F(1) = 5$

E. $F(1) = 5.5$

10. Consider the function $f(x) = 5x^{\frac{2}{5}}$ restricted to the domain $[-1, 1]$. Which of the following statements about $f(x)$ are TRUE?

I. On the domain $[-1, 1]$, f attains an absolute minimum value.

II. $x = 0$ is a critical number for f.

III. $f(x) \leq 1$ on the domain $[-1, 1]$

IV. Since $f(-1) = f(1)$, there exists a c between -1 and 1 where $f'(c) = 0$.

A. I, IV only

B. I, II, IV only

C. II, III only

D. I, II only

E. II, IV only

11. A storage crate is to be built in the shape of a box with a square base. It is to have a volume of 40 cubic feet. The material for the base costs \$2 per square foot, the material for the lid costs \$3 per square foot, and the material for the sides costs \$0.5 per square foot. If b is the width of the crate and h is the height, what are the dimensions of the crate that minimizes the cost?

A. $b = \sqrt{10}$ and $h = 4$

B. $b = \sqrt{5}$ and $h = 8$

C. $b = \sqrt{8}$ and $h = 5$

D. $b = \sqrt{2}$ and $h = 20$

E. $b = 2$ and $h = 10$

12. The derivative of the function $f(x)$ is given by $f'(x) = (x+5)^2(x+3)(x-1)(x-2)^2$. Then the function $f(x)$ has a local maximum at

A. $x = -5$ and $x = 1$ only

B. $x = -3$ and $x = 2$ only

C. $x = -3$ only

D. $x = 1$ only

E. $x = -3$ and $x = 2$ only